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Paraceratherium 在新疆准噶尔盆地北缘的发现及其意义[1)]

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关键词　新疆准噶尔盆地,晚渐新世,副巨犀

中图法分类号　Q915.877

2000 年,笔者在位于新疆准噶尔盆地北缘的福海县哈拉玛盖乡以南的萨尔多依腊地区测制乌伦古河组地层剖面时,在乌伦古河组和索索泉组之间的一套粗碎屑岩层中发现了一些哺乳动物化石。其中有孟津在 20004 化石点(46°35.779′N,87°43.818′E)发现的一具副巨犀下颌骨。该下颌保存了这类动物的一些重要特征,这些特征对于解决长期以来人们对于巨犀分类的有关争论以及含化石地层的时代提供了重要信息。

新疆萨尔多依腊的巨犀下颌支和牙齿的形态与 Forster-Cooper (1911: p. 713; 1924: Fig. 7) 描述的 Bugti 的 *Paraceratherium bugtiense* 标本在以下几个方面很相似:1) 下颌水平支底缘在颊齿列部位向下弯凸,其最大深度位于 m1、m2 之间;2) 联合部在 p2 前下弯;3) p2 之前的联合部上表面呈槽形,两侧形成锐脊;4) 仅有第一对下门齿(i1),第二、三对门齿已退化消失,该齿呈较长的圆锥形,伸向下前方,左右门齿基部相靠,顶端分离,其上无使用磨蚀痕迹,齿根很粗壮;5) p2 的形态及 p2 没有被磨蚀的迹象。Forster-Cooper 指出(1924, p. 369),他建立的 *Paraceratherium* 属的很特殊的特征是"a pair of downwardly turned tusks"。换句话说,是它具有 1) 下弯的下颌联合部和 2) 较长且呈锥形的第一下门齿。新疆萨尔多依腊的巨犀在这方面无疑与 *Paraceratherium* 属是一致的。但它较属型种 *P. bugtiense* 尺寸大、下颌水平支的相对深度大,且 p2 之前的联合部更下弯和背面的凹槽更深。

自 Forster-Cooper (1911) 创建副巨犀属(*Paraceratherium*) 以来,该属的含义多次发生变化。其原因是,在 Bugti 地点发现的巨犀类化石的个体大小相差较大。最初,Forster-Cooper 将其中一块尺寸较小、保存较好的下颌作为正型标本记述,同时将一块残破的下颌联合部、一些椎体和肢骨暂时归入了该种。但他指出归入该种的残破的下颌联合部、寰椎和肢骨相对于正型标本尺寸要大得多,可能为雄性个体,正型标本则为雌性个体。后来,Forster-Cooper (1923) 又为大尺寸的寰椎和肢骨建立了新属新种 *Baluchitherium osborni*,并认为该种与 Borissiak 所建立的 *Indricotherium turgaicum* 的肢骨十分相近(Forster-Cooper, 1923: p. 35)。

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Granger 和 Gregory(1936) 在记述内蒙古发现的 *Baluchitherium* 时认为, *Baluchitherium*、*Indricotherium*、*Paraceratherium* 可能是同物异名,它们之间的差异仅是种间的差异。Gromova (1959) 依据头骨形态的差异将巨犀类分为两个属 *Paraceratherium* 和 *Indricotherium*,取消了 *Baluchitherium* 属。Radinsky(1967) 提及了 Gromova 根据头骨形态将巨犀区分为 *Paraceratherium* 和 *Indricotherium* 两个属,但他指出,由于不能掌握巨犀头骨形态的变异范围,而不能肯定这些差异是否为属一级的差异。Lucas 和 Sobus(1989) 对巨犀类做了系统总结。他们认为 *Paraceratherium-Dzungariotherium* 和 *Indricotherium* 头骨之间的区别只是性别差异。*Paraceratherium* 为雌性, *Indricotherium* 为雄性,所谓两属间的形态差异,至多是同一个属内的种间差别。因此他们将 *Indricotherium* 归入 *Paraceratherium*。

笔者认为多数学者在讨论 *Paraceratherium* 分类位置时,只注意了头骨和臼齿形态的差异,很少分析下颌和下门齿特征。仅 Granger 和 Gregory (1936) 提到纽约自然历史博物馆的 AMNH 26166 标本(*Baluchitherium grangeri*,后更名为 *Indricotherium transouralicum*) 与 Forster-Cooper 所记述的 *P. bugtiense* 的下颌之间无属一级的区别(1936:p. 55)。为此我们对比了保存在纽约自然历史博物馆的 *I. transouralicum* 标本(AMNH 26166) 和 *P. bugtiense* 的下颌模型(AMNH 9027、9028)。尽管 AMNH 9027 与 AMNH 9028 标本大小悬殊,但二者下颌联合部门齿区及下门齿形态一致:下颌联合部门齿区下弯;下门齿发育,呈较长的圆锥形。而 AMNH 26166 标本(*I. transouralicum*) 下颌联合部门齿区向前平伸、不下弯,下门齿相对较短。因此 *I. transouralicum* 与 *P. bugtiense* 的下颌联合部及下门齿形态有着明显的差别。*I. transouralicum* 却与内蒙古乌尔丁鄂博晚始新世地层中发现的 *Urtinotherium incisivum* (Chow and Chiu, 1963: p. 233) 在下门齿(i1)、下颌形态上很相似。考虑到新疆萨尔多依腊的巨犀的下颌联合部门齿区明显下弯、下门齿相对较长且呈圆锥形等特征与 *P. bugtiense* 颇为相近,笔者推测巨犀在进化过程中曾经有一类群发生了下颌和下门齿的特化。如果将 *U. incisivum* 作为相对原始的巨犀类型(仍保存有 i2 和 i3、i1 不呈圆锥形、下颌联合部向前平伸),那么 i2 和 i3 退化消失、i1 较长并呈圆锥形和下颌联合部门齿区下弯应是 *Paraceratherium* 属的近裔性状。而在 *Indricotherium* 属中保留了下颌联合部向前平伸和较短的、非圆锥型的 i1 的原始性状。因此作者认为 *Indricotherium* 与 *Paraceratherium* 不应是同物异名而是两个不同的属。以 *Indricotherium transouralicum* 为代表的 *Indricotherium* 属不应归入 *Paraceratherium* 属。新疆萨尔多依腊的巨犀应归入 *Paraceratherium* 属。鉴于前面提及的与属型种的差异以及它与目前被归入该属的其他种(*P. prohorovi*、*P. lipidus*、*P. tienshanensis*) 的差异,将新疆萨尔多依腊的副巨犀命名为新种——苏氏副巨犀 *Paraceratherium sui* sp. nov.。

此外,笔者认为 Lucas 等将 *Dzungariotherium* 与 *Paraceratherium* 作为同一类群(1989:p. 372) 是不合适的。据邱占祥记载, *D. orgosensis*"下颌联合部向前急剧收缩,所以其下缘是上升,而不是下倾。其门齿已大大退化"(Chiu, 1973: p. 183～184),显然二者明显不同。此外,Lucas and Sobus (1989) 依据 Munthe and Coombs (1979) 对长颈鹿和爪兽头骨的对比研究结果,推断 *Indricotherium* 的头顶上隆是雄性巨犀的特征(1989:p. 372) 亦是不可靠的。因为在巨犀中头顶的隆起程度远低于长颈鹿和隆头爪兽,其隆起的形态也与后二者相差甚远,并不能适应"争偶战斗中的猛烈侧击"的需要。

Paraceratherium sui 在萨尔多依腊的发现对乌伦古河两岸的层位对比提供了新的依

据。过去晚渐新世铁尔斯哈巴合组仅发现于河北岸,其中产出巨犀(因破碎而无法鉴定)和晚渐新世小哺乳动物化石。*P. sui* 产自乌伦古河组和索索泉组之间的一套浅色碎屑岩,底部为棕黄色砾岩。其厚度不足 20m,且向东迅速尖灭,乌伦古河组被索索泉组底砾岩超覆。考虑到其位于乌伦古河组和索索泉组之间,又由于 *P. sui* 与一些铁尔斯哈巴合组的晚渐新世小哺乳动物共生,该沉积物与北岸的铁尔斯哈巴合组应为同期堆积,属铁尔斯哈巴合组地层。这一发现无疑将加深对该地区地质发展史的了解。

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DISCOVERY OF PARACERATHERIUM IN THE NORTHERN JUNGGAR BASIN OF XINJIANG

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Abstract *Paraceraterium sui* sp. nov. is represented by a lower jaw collected at Loc. 20004 (46°35.779′N, 87°43.818′E) of Saerduoyila, Halamagai Village, Fuhai County, Xinjiang Uygur Autonomous Region. The new species is similar to the type species of the genus, *P. bugtiense*, in general morphology of the mandible and teeth, but differs from the latter in larger size, the proportionally deeper horizontal ramus, the more anteroventrally curved symphysis and the much deeper trenched dorsal surface of symphysis. The associated small mammals indicates an age of Late Oligocene. The occurrence of *Paraceratherium sui* demonstrates that the genus *Paraceratherium* erected by Forster-Cooper, based on the lower jaw from Pakistan, is a valid taxon different from *Indricotherium*.

Key words North Junggar Basin, Late Oligocene, *Paraceratherium*

Since 1995, we have been working in areas on the banks of the Ulungur River in the northern Junggar Basin, Xinjiang, primarily (Wu et al., 1998; Ye et al., 2000; 2001a, b). Our work shows that terrestrial deposits of Late Cretaceous, Eocene, Oligocene, and Miocene are widely distributed in this region. A large number of mammal fossils from several localities were collected, some of which have been published (Wu et al., 1998, 2000; Bi, 1999, 2000; Bi et al., 1999; Meng et al., 1999, 2001a, b; Ye et al., 1999, 2000). Here we report a new species of *Paraceratherium* from the Late Oligocene at the Halamagai area.

The Halamagai area is probably the type locality of the "Ulunguhe" Formation (Tong et al., 1990; Ye et al., 2001a, b; Ye et al., in press). The "Ulunguhe" Formation is a set of light colored fluvial sediments that underlie the Suosuoquan Formation. Its definition and age remain controversial (Ye et al., 2001a, b; Ye et al., in press). The discovery of *Advenimus* from the lower part of the "Ulunguhe" Formation indicates the age of Eocene (Meng et al., 2001). A lens of coarse sediments, probably representing a channel fill, on the top of the "Ulunguhe" Formation generates fossils, dominantly small mammals (*Desmatolagus* sp., *Sinolagomys* sp., *Plesiosminthus* sp., *Bohlinosminthus parvulus*, *Litodonomys* sp., Ansomyinae gen. et sp. nov., *Vasseuromys* sp. etc.), which are correlative to those from the Late Oligocene fauna at Tieersihabahe (Wu et al., 1998; Ye et al., 2000; 2001a, b; Ye et al., in press). Because of its lithological similarity to that of the type Tieersihabahe Formation, we also consider the channel fill is the Tieersihabahe Formation. Among the fossils is a pair of lower jaw of *Paraceratherium* discovered by Meng Jin in 2000.

Mammalia Linnaeus, 1758
Perissodactyla Owen, 1848
Rhinocerotoidea Gray, 1825
Hyracodontidae Cope, 1879
Paraceratherium **Forster-Cooper, 1911**
Paraceratherium sui **sp. nov.**
(Figs. 1～2)

Holotype A pair of fragmentary lower jaws with broken incisors (i1), left p2-m3 and right p3-m3, IVPP V 13382.

Locality and age Late Oligocene Tieersihabahe Formation, Saerduoyila, Halamagai Village, Fuhai County, Xinjiang, China.

Etymology the species name is in honor of Mr. Su Jianfeng, who has been doing a lot of work in the fields.

Diagnosis The new species is similar to the type species of the genus, *Paraceratherium bugtiense*, in general morphology of the mandible and teeth, but differs in the significantly larger size, proportionally much deeper horizontal ramus, more ventrally curved symphysis and deeper dorsally trenched symphysis.

Description The left mandible was seriously weathered, while the right one was preserved in the matrix and is thus in a better condition. The left horizontal ramus was compressed posteromedially so that the last molars are almost in contact. The horizontal ramus of the right mandible is closely similar to that of *P. bugtiense* (Forster-Cooper, 1924: fig. 7). Although the ventral edge below the molars was damaged, it is still clear that the horizontal ramus is deep, with the deepest region at the level between the m1 and m2. The symphysis is robust and sharply curves ventrally anterior to the p2 (Figs. 1 and 2).

On the dorsal surface of the symphysis is a deep trench that is bounded laterally by the ridge-like diastemal region of the mandible, which is also similar to that of *P. bugtiense* (Forster-Cooper, 1911: p. 713). The mandible is 230 mm deep at the level of the p3, the sysmphysis is 300mm long anterior to the p2 (It is measured 68mm and 128mm respectively for *P. bugtiense*).

There is only one pair of incisors (i1). Both are fractured. The right remains its general shape. The incisor is large, long and cone-shaped, located at the tip of the symphysis, and pointed anteriorly and slightly ventrally. The base of the tooth is broad and adorned with well-developed cingulum. The incisors are in contact at their bases but slightly divergent at the tips. There is no wear facet on the incisor. The roots of the incisors are stout. The right i1 is ca. 73 mm high and ca. 55 mm wide at the base.

The p1 is lost. A significant diastema is between the incisor and the p2. The left p2 is cracked, but its morphology is kept. It has one root that is transversely compressed. There is no indication of wear. Similar to *P. bugtiense* (Forster-Cooper, 1924), the protoconid is prominent. Three ridges lead from the tip of the cusp outwards. The first ridge stretches anteriorly and ends as a weak enamel column. The second ridge extends posterolaterally to the posterior edge of the tooth, turns slightly medially, and forms a stronger column. The third one runs posteromedially. Cingula around the tooth are developed. The left p2 is 39 mm long and 31 mm wide.

The p3 is preserved on each side, with the left one being in better condition. The crown is high and moderately worn. The occlusal view of p3 is roughly triangular, narrow anteriorly and wide posteriorly. The tooth is molariform, although the trigonid is narrower than that of p4 and molars. The metaconid is well developed. A rib is on the labial surface at the level of the protoconid. Cingula are well developed. The left p3 is 57 mm long and 48mm wide at the talonid.

The right p4 is better preserved and is moderately worn. It is molariform and is rectangular in occlusal view. The trigonid basin is shallower than the talonid one. Cingula are well developed. The

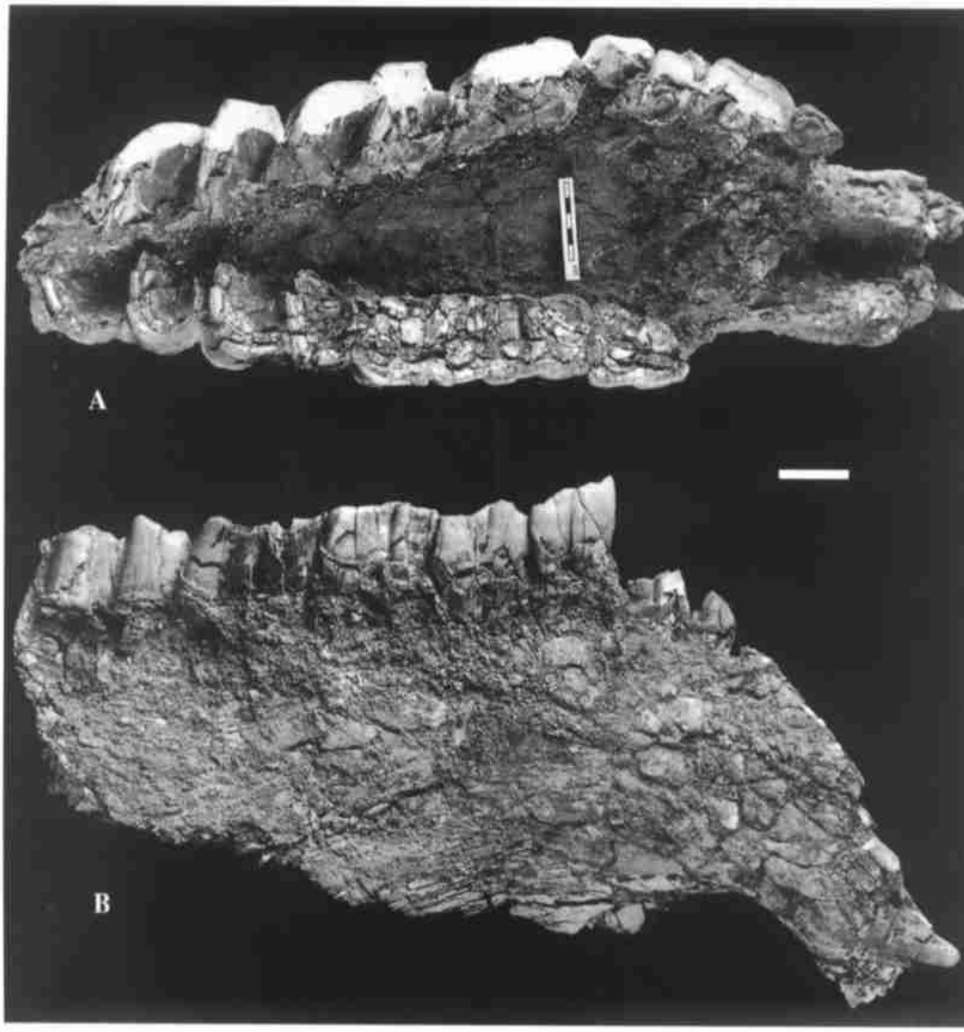


图 1　苏氏副巨犀(新种)下颌 ,V 13382 ,比例尺 = 5cm

Fig. 1　Lower jaw of *Paraceratherium sui* sp. nov. , V 13382 , scale bar = 5cm

A. 背面观 dorsal view ; B. 右侧唇面观 ,图上所见右起前两枚颊齿乃是左 p2 - 3 的舌面视 right labial view , the first two cheek teeth from the right seen in the picture are left p2 - 3

tooth is 65 mm long and 53 mm wide.

All molars are fractured. In general the molars are high crowned and are similar to each other , although the tooth becomes larger and the hypolophid becomes more posteriorly shifted and oblique from m1 to m3. The m3 is the best-preserved molar. The paralophid is relatively low and narrow , in contrasting to a higher and wider metalophid. The hypolophid extends posteromedially. The trigonid basin is shallow , whereas the talonid basin is deeper and wider. The cingulum is well developed. The dimensions of the right molars are : m1 (81 mm long , 55 mm wide) , m2 (91.6mm , 58 mm) , and m3 (102mm , 59mm) .

Comparison and discussion　The genus *Paraceratherium* was based on a moderately complete lower jaw of an older individual from Bugti , Baluchistan , Pakistan (Forster-Cooper ,

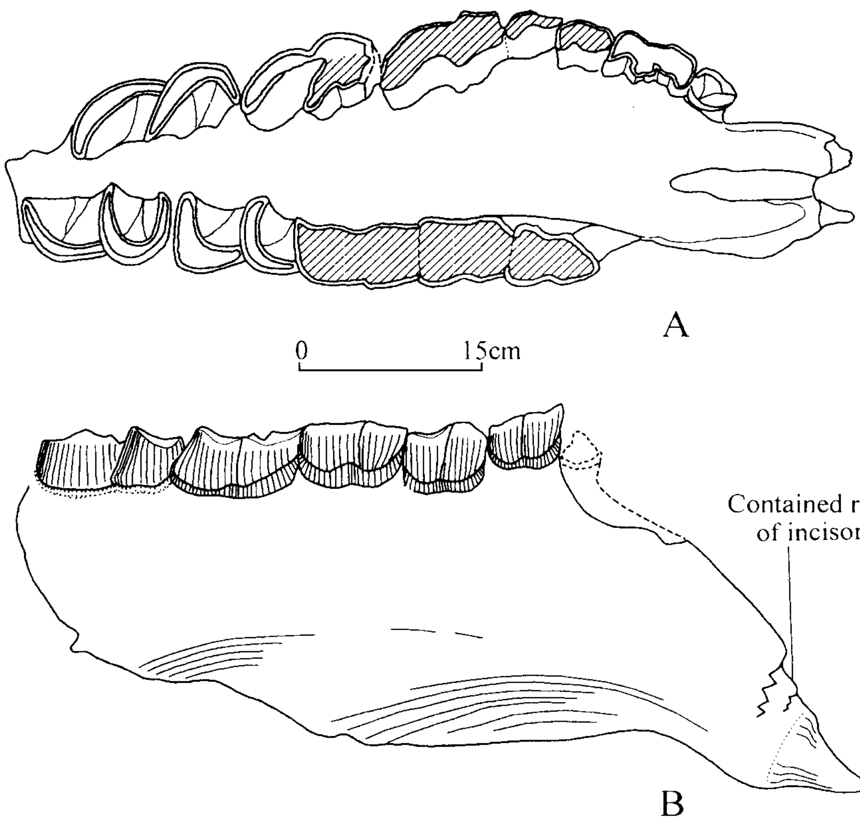


图 2　苏氏副巨犀(新种) 下颌线条图 ,V 13382

Fig. 2　Line drawing of lower jaw of *Paraceratherium sui* sp. nov. , V 13382

A. **背面观 ,示颊齿冠面** dorsal view , showing occlusal view of the cheek teeth ; B. **部分复原的右下颌唇面图 ,示下颌腹缘、齿隙背缘和齿列** labial view of partially reconstructed right mandible , showing the ventral mandible border , dorsal rim of diastema , and the dentition with the reconstructed p2

1911) . The genus is characterized by "the unusual position and shape of the two incisors ", which distinguished *Paraceratherium* from other rhinoceroses known at that time. Based on additional specimens , Forster-Cooper (1924) reconstructed the ventral outline of the horizontal ramus of the *P. bugtiense* mandible and described the cranium and dentition. Forster-Cooper (1924 :p. 369) emphasized the diagnosis of *Paraceratherium* :" This specimen shows a very peculiar feature of the front teeth , which instead of being procumbent , or even upturned , as in other rhinoceroses , are formed into a pair of downwardly turned tusk. On the strength of this well-marked character a new genus *Para-ceratherium* was formed for the species ". Since then , various workers have expressed different opinions on the taxonomic position of the genus (Granger and Gregory , 1936 ; Gromova , 1959 ; Radinsky , 1967 ; Fortelius and Kappelman , 1993 ; Lucas and Emry , 1996) , so that the definition of the genus has been unclear. We follow McKenna and Bell (1997) to consider *Paraceratherium* as a va-lid genus , distinguishable from *Indricotherium*. The diagnosis of *Paraceratherium* includes the ventrally-curved symphysis and well-developed , long and conical lower incisor (i1) .

The mandible from Saerduoyila is similar to that of *Paraceratherium bugtiense* in the following aspects : 1) The horizontal ramus of the mandible is convex ventrally , with the deepest region being

at the level between m1 and m2. 2) The symphysis curves anteroventrally. 3) The dorsal side of the symphysis forms a deep, longitudinal trench, which is bordered with sharp ridges. 4) Incisors (i1) well-developed, conical, relatively long, anteroventrally projected, bearing no wear facets, and incisors of the two sides in contact at their bases but separate distally. 5) Similar p2 morphology and wear pattern (unworn). Therefore, the Saerduoyila specimen is considered to belong to *Paraceratherium*.

The Saerduoyila mandible is considerably larger than that from Bugti, with the total length of cheek teeth being 30 % longer. The horizontal ramus is proportionally deeper and the symphysis is more ventrally curved and with considerably deeper dorsal trench in the Saerduoyila specimen. The premolar-molar length ratio of the Bugti specimens is 0.65, whereas that of the Saerduoyila specimen is 0.55. The p2 cingulid of Bugti specimen is much higher than that of the Saerduoyila specimen. Based on these morphological differences and the geographic distributions, we consider the Saerduoyila specimen a species different from *P. bugtiense*.

Before *Indricotherium* was regarded as a synonym of *Paraceratherium* (Lucas and Sobus, 1989), *Paraceratherium* contains three other species: *P. prohorovi* from the Late Oligocene of the former Soviet Union, *P. tienshanensis* (Chow and Xu, 1959), and *P. lipidus* (Xu and Wang, 1978). Of the three species, *P. prohorovi* has specimens of cranium and mandibles. The skull of *P. prohorovi* (Gromova, 1959: fig. 2A) differs from that of *P. bugtiense* in being higher, skull roof more arched in lateral view, zygomatic arch slimmer and more straight, occipital condyles projecting backward horizontally. The mandibles differ from that of *P. bugtiense* in being straight, not ventrally curved (Gromova, 1959: No. 66～42, fig. 2; No. 210～454, P1. II; No. 210～456, P1. IV). Moreover, the mandible of *P. prohorovi* is shallower than that of *P. bugtiense*, with a straight lower border. Based on comparison of skull, teeth and postcranial specimens, Xu and Wang (1978) thought *P. prohorovi* should not be placed within *Paraceratherium*, a view that we agree with.

Paraceratherium lipidus was based on a skull from the Turpan Basin of Xinjiang, which is generally similar to that of *P. bugtiense* in morphology and size. Because the lower jaw was unknown for this species, we cannot compare it directly with the Saerduoyila specimen. However, *P. lipidus* is much smaller than the Saerduoyila specimen.

Paraceratherium tienshanensis was based on a fragmentary left mandible and a broken M3 from the Hami Basin. The specimens were originally regarded as *Indricotherium* cf. *grangeri* (Chow and Xu, 1959). Qiu (Chiu, 1962) named *Paraceratherium tienshanensis* based on the same specimens because the M3 morphology and larger size of the Hami specimens differ from those of *Indricotherium*. Owing to breakage of key morphology of the mandible, such as the symphysis, in the specimen of *P. tienshanensis*, it is beyond our ability to make any meaningful comment on the taxonomy of *P. tienshanensis*. Nonetheless, based on its elongated molars, much larger size, and later distribution, it is distinctive from the Saerduoyila specimen. To sum up, the Saerduoyila specimen differs from all species assigned to the genus *Paraceratherium* and is considered here as a new species.

Since the proposal of *Paraceratherium* (Forster-Cooper, 1911), the definition of the genus has been continuously changed. One of reasons is that the specimens from Bugti show considerable variation of size. The type specimen was a smaller but better-preserved mandible. Forster-Cooper assigned a broken symphysis of a mandible and some postcranial elements to the same species; he pointed out that the broken symphysis and atlas represented probably a male individual much larger than the type. However, Forster-Cooper named later (1923) a new genus and species, *Baluchitherium osborni*, based on the atlas and limb bones and pointed out that these limb bones were much similar to those of *Indricotherium turgaicum* erected by Borissiak in 1915.

While describing specimens of *Baluchitherium* from Nei Mongol, Granger and Gregory (1936) realized that *Baluchitherium*, *Indricotherium*, and *Paraceratherium* might be synonyms; the

differences among these taxa probably distinguished them as different species of the same genus. Based on cranial morphology, Gromova (1959) recognized *Paraceratherium* and *Indricotherium* as valid genera and abandoned *Baluchitherium*, a view followed by Radinsky (1967). However, Radinsky (1967) also pointed out that it is unclear whether the cranial differences were at the generic level because the cranial variations of these taxa were not well-documented. Lucas and Sobus (1989) considered that the differences in the cranium between *Paraceratherium-Dzungariotherium* and *Indricotherium* represented sexual dimorphisms, with *Paraceratherium* being the female and *Indricotherium* being the male; therefore, the differences were at the species level. Lucas and Sobus (1989) thus placed the large species of *Indricotherium* within *Paraceratherium*.

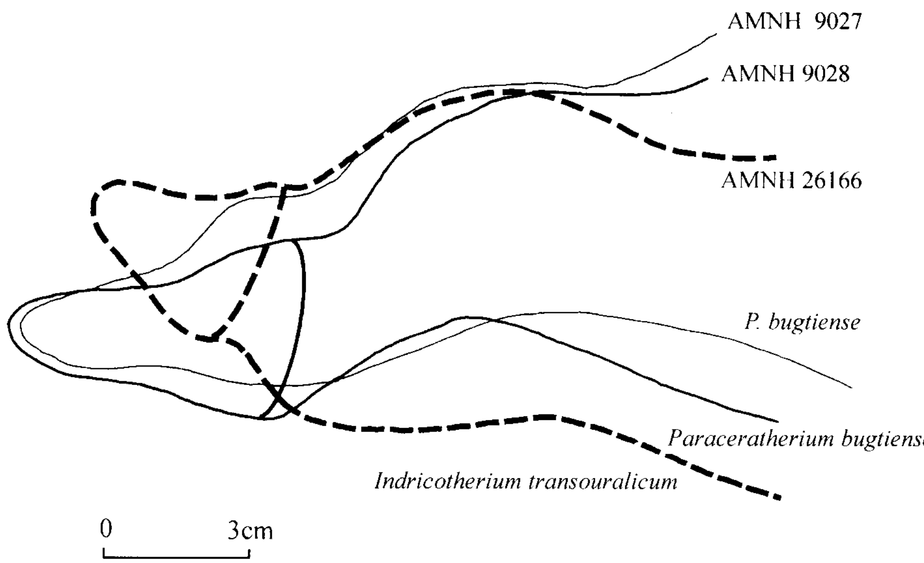


图 3 *Indricotherium transouralicum* **与** *Paraceratherium bugtiense* **的下颌前端轮廓,示两属之间在下颌联合部伸展方向、第一下门齿的大小和形态差别(依据纽约自然历史博物馆的标本和模型)**

Fig. 3 Sketch drawing of the front part of the mandible of *Indricotherium transouralicum* and *Paraceratherium bugtiense* based on the specimen and casts housed in AMNH, showing the different extending directions of the mandible symphysis, and the different incisor size and morphology of the two genera

Most studies on *Paraceratherium*, as cited above, focused primarily on the cranial and molar features, and paid little attention to the lower jaw and incisor morphologies. Granger and Gregory (1936) are one of a few who mentioned the lower jaw morphologies. They thought that the lower jaw difference between AMNH 26166 (which was originally referred to as *Baluchitherium grangeri*, but later renamed as *Indricotherium transouralicum*) and *Paraceratherium bugtiense* was not at the generic level. We observed and compared AMNH 26166 and casts of *P. bugtiense* (AMNH 9027, 9028). Although AMNH 9027 and AMNH 9028 differ in size, the symphysis of lower jaws and lower incisors are similar in that the symphysis curves anteroventrally and the incisors are robust, conical, and relatively long. In contrast, the lower incisors of AMNH 26166 are relatively small, and are more similar to those of *Urtinotherium incisivum* from the Late Eocene Urden Obo locality, Nei Mongol (Chow and Chiu, 1963) in having a ventromedial crest, two dorsal ridges, and well-deve-loped lingual cingulid. In addition, their mandibles are comparable in showing no anteroventral curvature of the symphysis. It seems that those that have the ventrally curved symphysis and conical incisors, such as *P. bugtiense* and the *P. sui*, may represent a unique lineage. *U. incisivum* is probably a more primitive form in retaining both i2 and i3, in non-conical i1, and anteriorly stretched symphysis. Compared to it, lower jaw features in *Paraceratherium*, such as strong,

conical and long incisors, anteroventrally curved symphysis, and deeply trenched dorsal surface of the symphysis may be considered as derived. Although the taxonomies of *Paraceratherium* and *Indrico-therium* may still remain open, based on the importance of lower jaws and incisors we prefer to consider *Paraceratherium* and *Indricotherium* as two valid taxa.

In addition, we believe the treatment of *Dzungariotherium* and *Paraceratherium* as the same taxon (Lucas and Sobus, 1989) is also debatable. In the description of *Dzungariotherium* Chiu (1973: 183～184) writes "the lower jaw symphysis contracts considerably anteriorly, such that the ventral rim of the symphysis extends dorsally rather than curves ventrally. The incisors are greatly reduced." (original in Chinese). Therefore, *Dzungariotherium* differs from *Paraceratherium* at least in their lower jaw and incisor morphologies. It is questionable to assert that *Indricotherium* represents the male individual of *Paraceratherium* depending on the comparison of the cranial morphology of *Indricotherium* with those of dome-skulled calichotheres (Lucas and Sobus, 1989; Munthe and Coombs, 1979), because the degree of arch and shape of the skull dome in those forms are quite different.

The discovery of *Paraceratherium sui* at Saerduoyila provides evidence for stratigraphic correlation of beds on the two sides of the Ulungur River. Previously, it was thought that the Late Oligocene sediments were only distributed along the northern region of the river. The deposits yielding the *Paraceratherium sui* and some small mammals are a set of less than 20m light-colored sandstone with basal conglomerates. The beds lay between the "Ulunguhe Formation" and the red beds of Suosuoquan Formation. The fossils indicate that these sediments are probably correlative to the Tieersihabahe Formation that is known on the northern region of the Ulungur River.

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